Direct Measurement of ^{248}Es and ^{249}Es Production in the ^{249}Cf(p,xn)$^{250-x}$Es Reaction

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^{248}Es and ^{249}Es were produced in the ^{249}Cf(p,xn)$^{250-x}$Es reaction with 21 MeV protons on a 14.6 μg/cm^2 ^{249}Cf target. Production cross sections of ^{248}Es and ^{249}Es at proton energies of 18 and 23 MeV had been previously measured by Y. Hatsukawa et al.[1] We have measured cross sections for the same isotopes at 21 MeV which were approximately a factor of five lower than those reported by Hatsukawa. In our experiment there were large uncertainties as to the efficiency of our gas-jet transport system from the target chamber to the counting area. Even with large error bars, our points did not match the previously reported values.

In this experiment, we assayed a gold catcher foil placed directly behind the ^{249}Cf target under vacuum in order to eliminate uncertainty in our transport efficiency. Based on calculations by J.D. Leyba[2] the collection efficiency of the catcher foil should be nearly 100%. After a one hour irradiation the foil was removed and dissolved in aqua regia containing ^{241}Am yield tracer. The resulting solution was passed through a Dowex AG1-X8 anion exchange resin (200-400 mesh) column and washed with concentrated HCl in order to remove the trivalent actinides from the column. The HCl solution was dried on a Pt disk and counted with a Si solid state alpha spectrometer system.

The production cross section of ^{248}Es at 21 MeV was measured to be 1884±589 μb and for ^{249}Es it was 539±141 μb. Our new values are much higher than in our previous experiment, in which we assumed a gas-jet yield of 50% and a chemical yield of 50%, which was based on ^{249}Cf knocked out of the target. Within error, these new values also agree with those reported by Hatsukawa. Figure 1 is a comparison of results from Hatsukawa and from our experiments. Based on our new cross sections, it appears that the gas-jet yield in the previous experiments was only about 5%-15%. This may be due to a change in target orientation in the light ion multiple (LIM) target system used in our previous experiments which may have prevented the He gas-jet from sweeping out the reaction products completely. Because of these results we will be testing various target arrangements to optimize He jet transport efficiency out of the LIM system for future experiments.

Footnotes and References

1. Y. Hatsukawa et al., Nuclear Physics A, 500, 90 (1989.)

2. J.D. Leyba, LBL Report LBL-29540 (1990.)

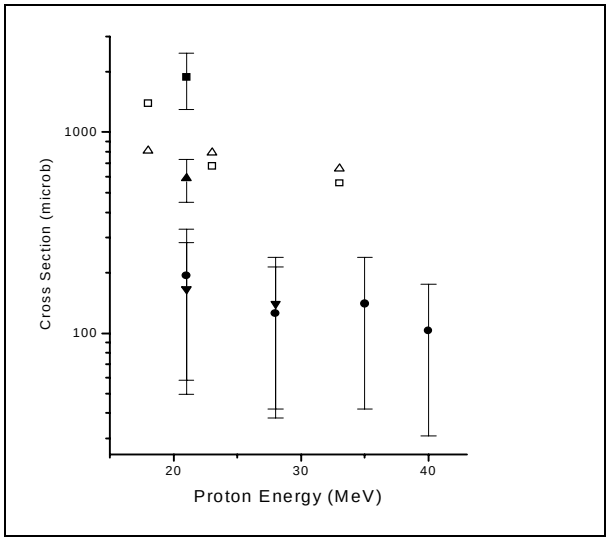

Fig. 1. Comparison of results. Open points are from reference 1 and do not include errors. Open squares - ^{248}Es. Open triangles - ^{249}Es. Closed square - ^{248}Es, this report. Closed up-triangle - ^{249}Es, this report. Closed circles - ^{248}Es, previous experiment. Closed down-triangles - ^{249}Es, previous experiment.